```
p:tac
AAATGAGCTG TTGACAATTA ATCATCGGCT CGTATAATGT GTGGAATTGT GAGCGGATAA
                    EcoRI  SacI   KpnISmaI
CAATTTCACA CAGGAAACAG AATTCGAGCT CGGTACCCGG GCTACATGGA GATTAACTCA
                                      RBS            |-> α-globin
ATCTAGAGGG TATTAATAAT GTATCGCTTA AATAAGGAGG AATAACATAT GGTGCTGTCT

CCTGCCGACA AGACCAACGT CAAGGCCGCC TGGGGTAAGG TCGGCGCGCA CGCTGGCGAG

TATGGTGCGG AGGCCCTGGA GAGGATGTTC CTGTCCTTCC CCACCACCAA GACCTACTTC

CCGCACTTCG ATCTGAGCCA CGGCTCTGCC CAGGTTAAGG GCCACGGCAA GAAGGTGGCC

GACGCGCTGA CCAACGCCGT GGCGCACGTG GACGACATGC CCAACGCGCT GTCCGCCCTG

AGCGACCTGC ACGCGCACAA GCTTCGGGTG GACCCGGTCA ACTTCAAGCT CCTAAGCCAC

TGCCTGCTGG TGACCCTGGC CGCCCACCTC CCCGCCGAGT TCACCCCTGC GGTGCACGCC
                                                          ->|
TCCCTGGACA AGTTCCTGGC TTCTGTGAGC ACCGTGCTGA CCTCCAAATA CCGTTAAACT
                                 RBS            |-> β-globin
AGAGGGTATT AATAATGTAT CGCTTAAATA AGGAGGAATA ACATATGGTG CACCTGACTC

CTGAGGAGAA GTCTGCCGTT ACTGCCCTGT GGGGCAAGGT GAACGTGGAT GAAGTTGGTG

GTGAGGCCCT GGGCAGGCTG CTGGTGGTCT ACCCTTGGAC CCAGAGGTTC TTTGAGTCCT

TTGGGGATCT GTCCACTCCT GATGCTGTTA TGGGCAACCC TAAGGTGAAG GCTCATGGCA

AGAAAGTGCT CGGTGCCTTT AGTGATGGCC TGGCTCACCT GGACAACCTC AAGGGCACCT

TTGCCACACT GAGTGAGCTG CACTGTGACA AGCTGCACGT GGATCCTGAG AACTTCAGGC
        β108Asn->Gln
TCCTGGGACA AGTACTGGTC TGTGTGCTGG CCCATCACTT TGGCAAAGAA TTCACCCCAC

CAGTGCAGGC TGCCTATCAG AAAGTGGTGG CTGGTGTGGC TAATGCCCTG GCCCACAAGT
     ->|SphI      rrB(5S,T1,T2)
ATCACTAAGC ATGCATCTGT TTTGGCGGAT GAGAGAAGAT TTTCAGCCTG ATACAGATTA
           NsiI
......
```

FIG. 1A

```
p:tac
AAATGAGCTG TTGACAATTA ATCATCGGCT CGTATAATGT GTGGAATTGT GAGCGGATAA
                      EcoRI  SacI   KpnISmaI
CAATTTCACA CAGGAAACAG AATTCGAGCT CGGTACCCGG GCTACATGGA GATTAACTCA
                                      RBS            |-> α-globin
ATCTAGAGGG TATTAATAAT GTATCGCTTA AATAAGGAGG AATAACATAT GGTGCTGTCT

CCTGCCGACA AGACCAACGT CAAGGCCGCC TGGGGTAAGG TCGGCGCGCA CGCTGGCGAG

TATGGTGCGG AGGCCCTGGA GAGGATGTTC CTGTCCTTCC CCACCACCAA GACCTACTTC

CCGCACTTCG ATCTGAGCCA CGGCTCTGCC CAGGTTAAGG GCCACGGCAA GAAGGTGGCC

GACGCGCTGA CCAACGCCGT GGCGCACGTG GACGACATGC CCAACGCGCT GTCCGCCCTG

AGCGACCTGC ACGCGCACAA GCTTCGGGTG GACCCGGTCA ACTTCAAGCT CCTAAGCCAC

TGCCTGCTGG TGACCCTGGC CGCCCACCTC CCCGCCGAGT TCACCCCTGC GGTGCACGCC
                                                          ->|
TCCCTGGACA AGTTCCTGGC TTCTGTGAGC ACCGTGCTGA CCTCCAAATA CCGTTAAACT
                                 RBS             |-> β-globin
AGAGGGTATT AATAATGTAT CGCTTAAATA AGGAGGAATA ACATATGGTG CACCTGACTC

CTGAGGAGAA GTCTGCCGTT ACTGCCCTGT GGGGCAAGGT GAACGTGGAT GAAGTTGGTG

GTGAGGCCCT GGGCAGGCTG CTGGTGGTCT ACCCTTGGAC CCAGAGGTTC TTTGAGTCCT

TTGGGGATCT GTCCACTCCT GATGCTGTTA TGGGCAACCC TAAGGTGAAG GCTCATGGCA

AGAAAGTGCT CGGTGCCTTT AGTGATGGCC TGGCTCACCT GGACAACCTC AAGGGCACCT

TTGCCACACT GAGTGAGCTG CACTGTGACA AGCTGCACGT GGATCCTGAG AACTTCAGGT
β105Leu->Trp
GGCTAGGCAA CGTGCTGGTC TGTGTGCTGG CCCATCACTT TGGCAAAGAA TTCACCCCAC

CAGTGCAGGC TGCCTATCAG AAAGTGGTGG CTGGTGTGGC TAATGCCCTG GCCCACAAGT
     ->|SphI      rrB(5S,T1,T2)
ATCACTAAGC ATGCATCTGT TTTGGCGGAT GAGAGAAGAT TTTCAGCCTG ATACAGATTA
           NsiI
......
```

FIG. 1B

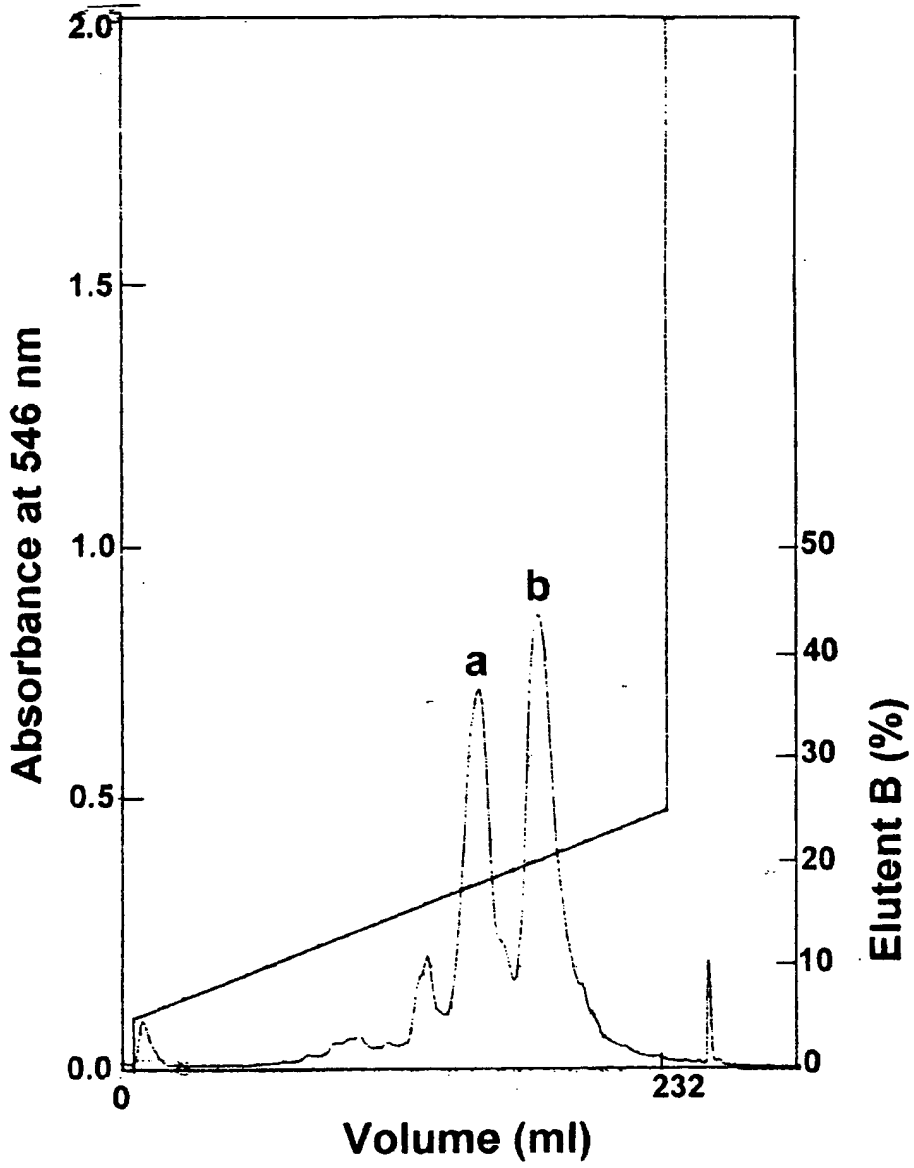

2.0
1.5
1.0
0.5
0.0
Absorbance at 546 nm
a
b
50
40
30
20
10
0
Elutent B (%)
0
232
Volume (ml)

FIG. 2A

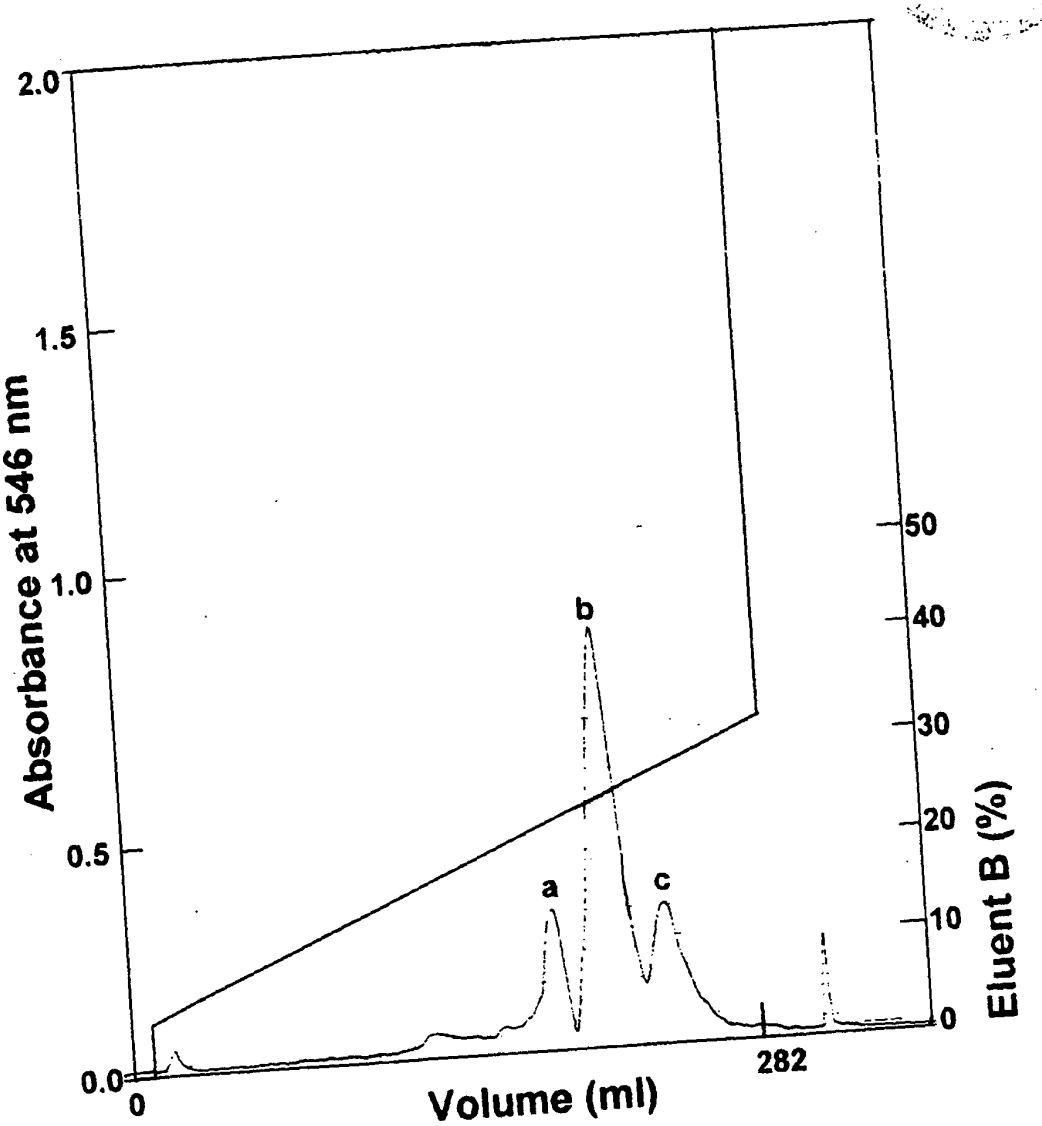

2.0
1.5
1.0
0.5
0.0
Absorbance at 546 nm
0
282
Volume (ml)
50
40
30
20
10
0
Eluent B (%)
a
b
c

FIG. 2B

FIG. 3A

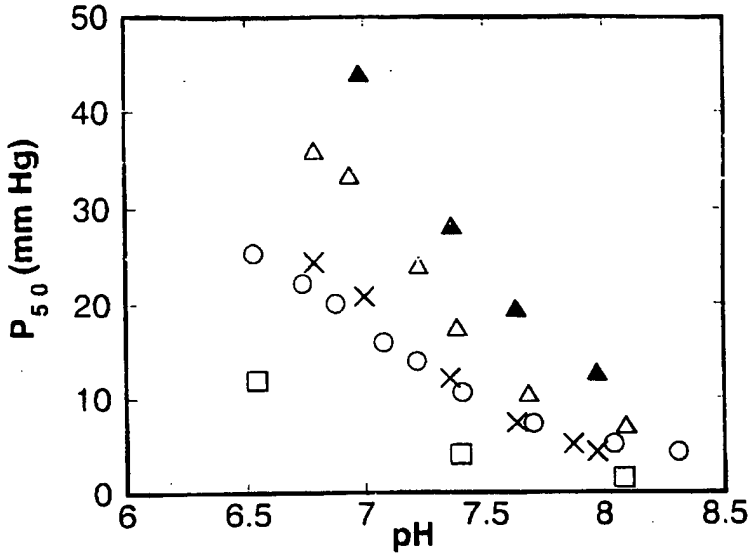
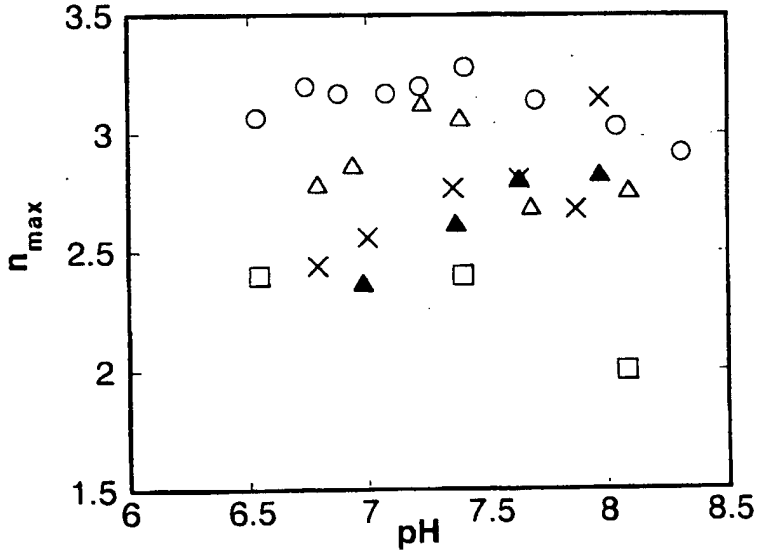

50
40
30
20
10
0
P_{50} (mm Hg)
6
6.5
7
7.5
8
8.5
pH

FIG. 3B


3.5
3
2.5
2
1.5
n_{max}
6
6.5
7
7.5
8
8.5
pH

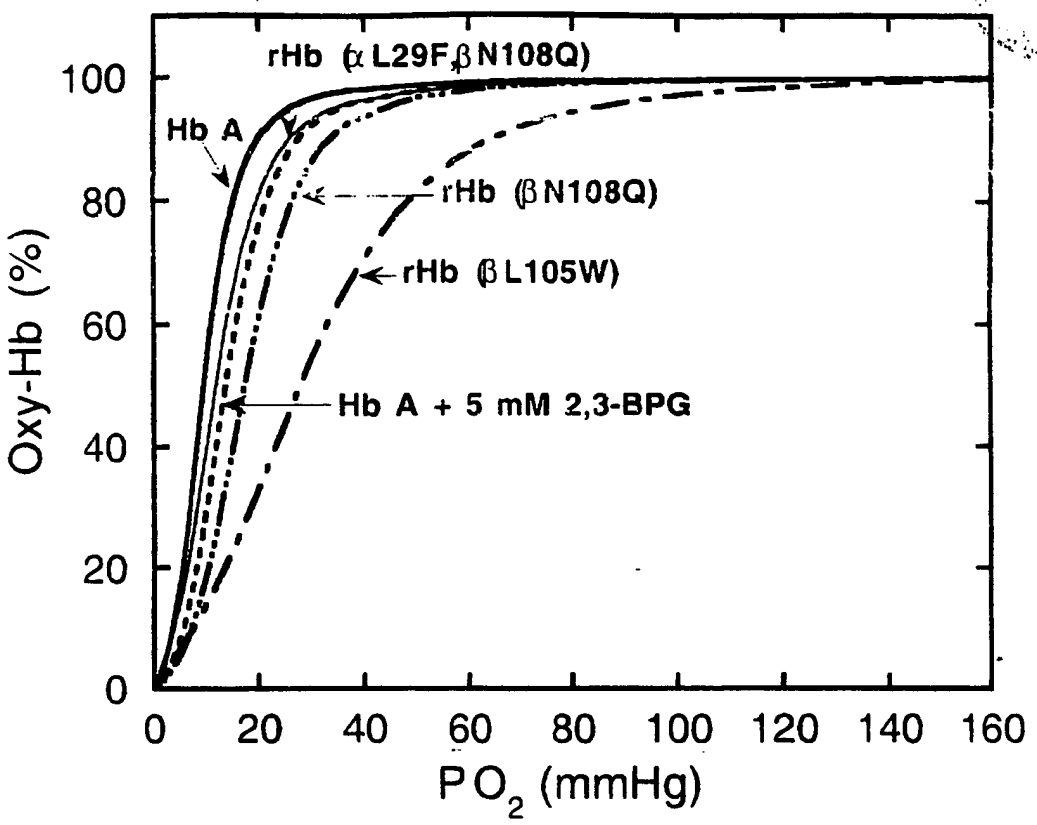

rHb (αL29F,βN108Q)
Hb A
rHb (βN108Q)
rHb (βL105W)
Hb A + 5 mM 2,3-BPG
Oxy-Hb (%)
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
PO2 (mmHg)

FIG. 4

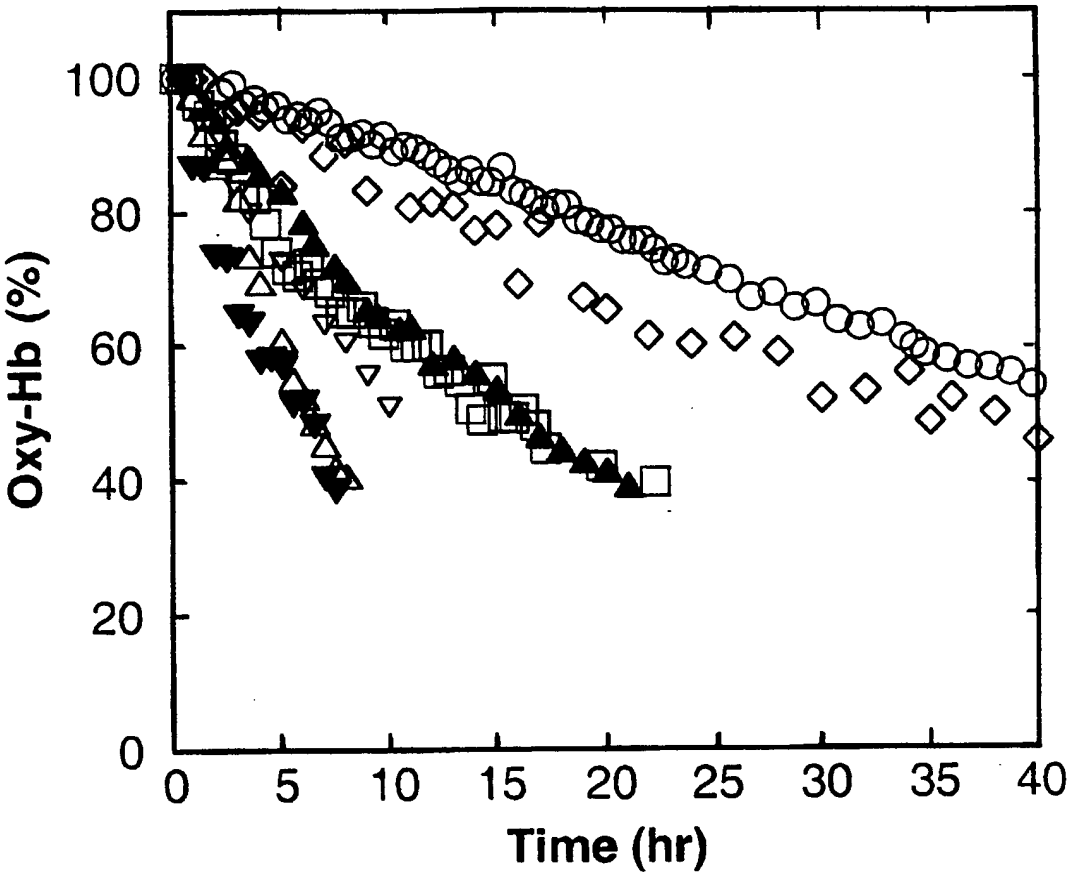


FIG. 5

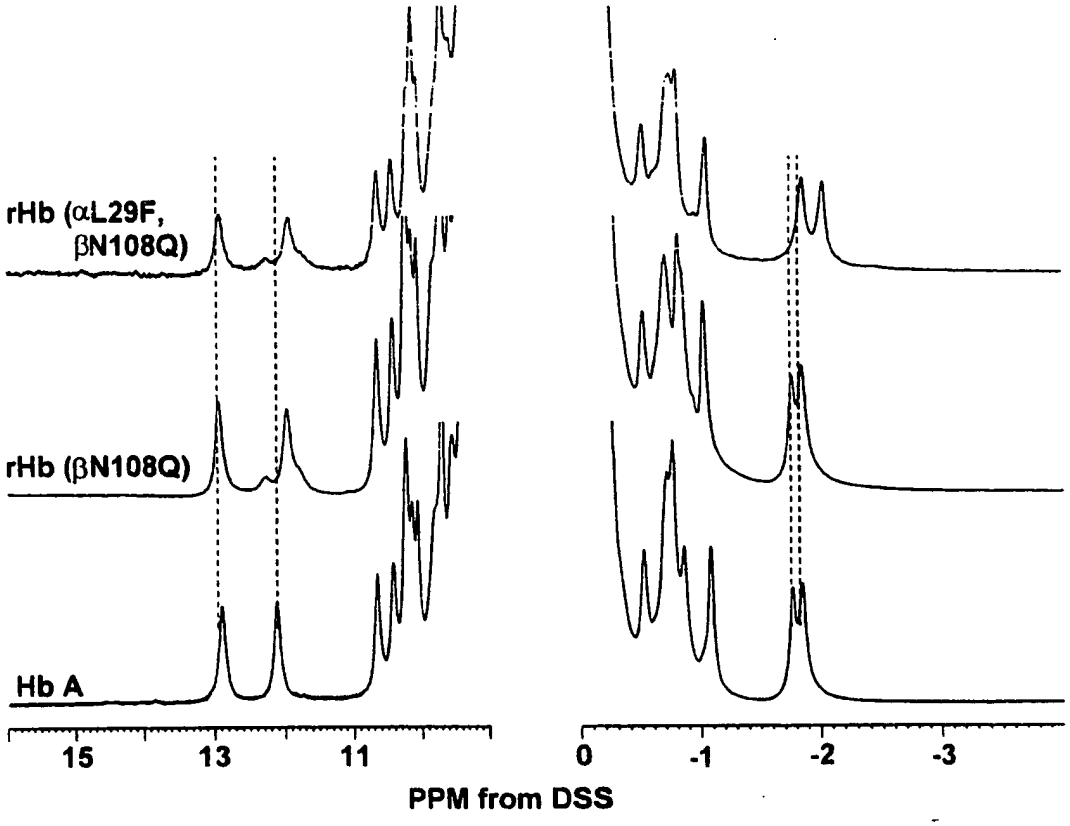


FIG. 6A

FIG. 6B

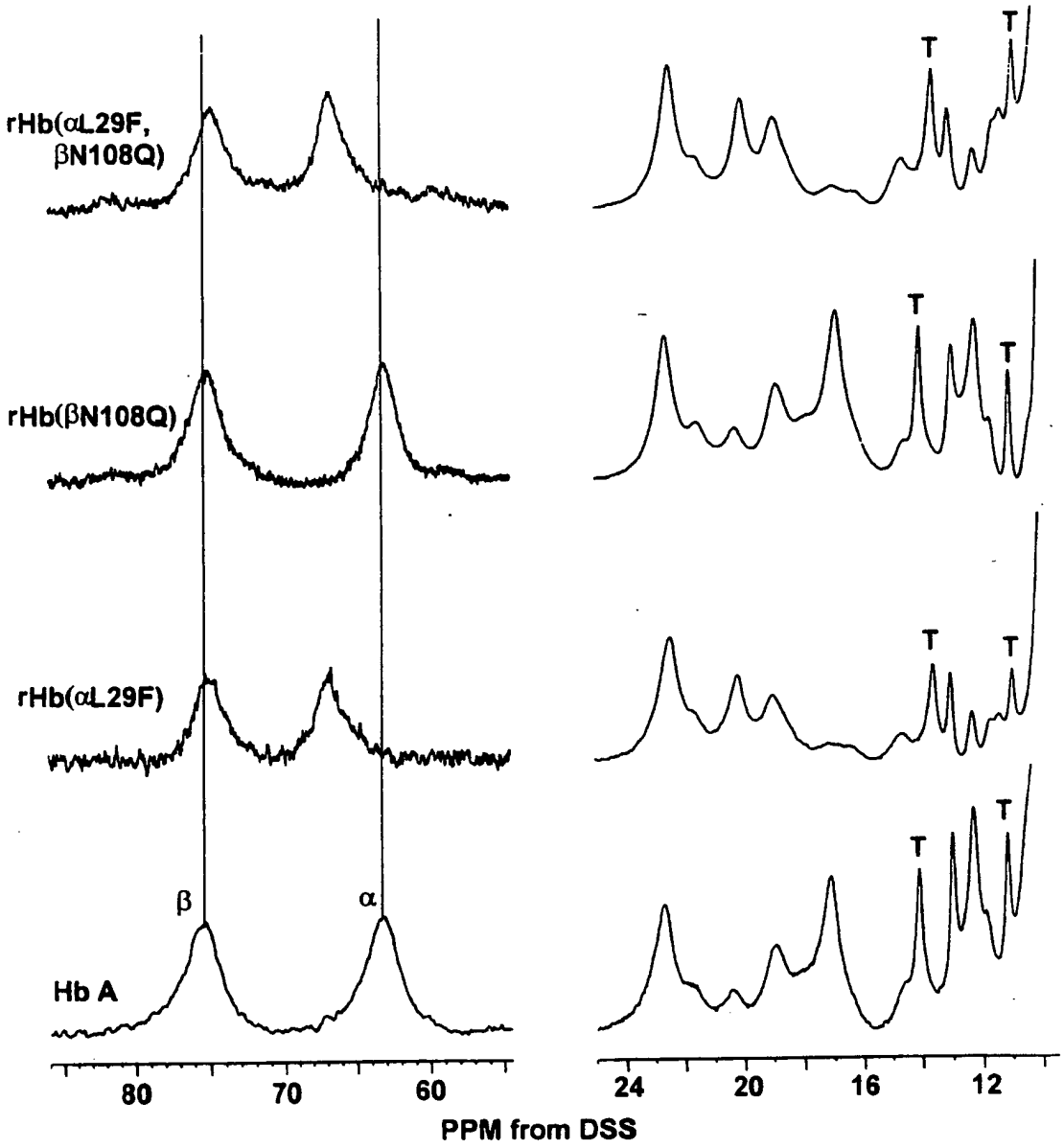

rHb(αL29F, βN108Q)
rHb(βN108Q)
rHb(αL29F)
Hb A
β
α
T
80
70
60
24
20
16
12
PPM from DSS

FIG. 7A

FIG. 7B

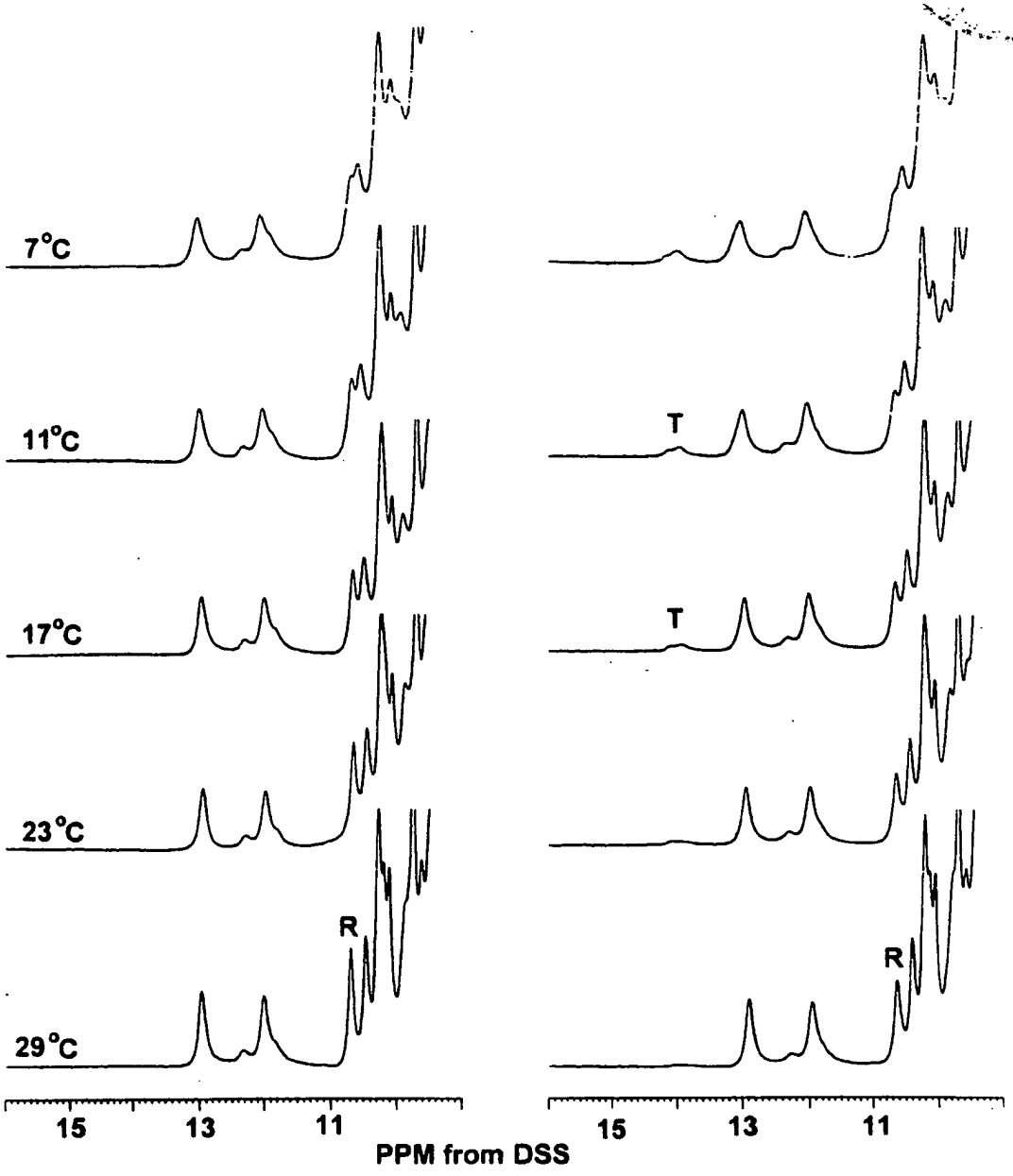


FIG. 8A

FIG. 8B

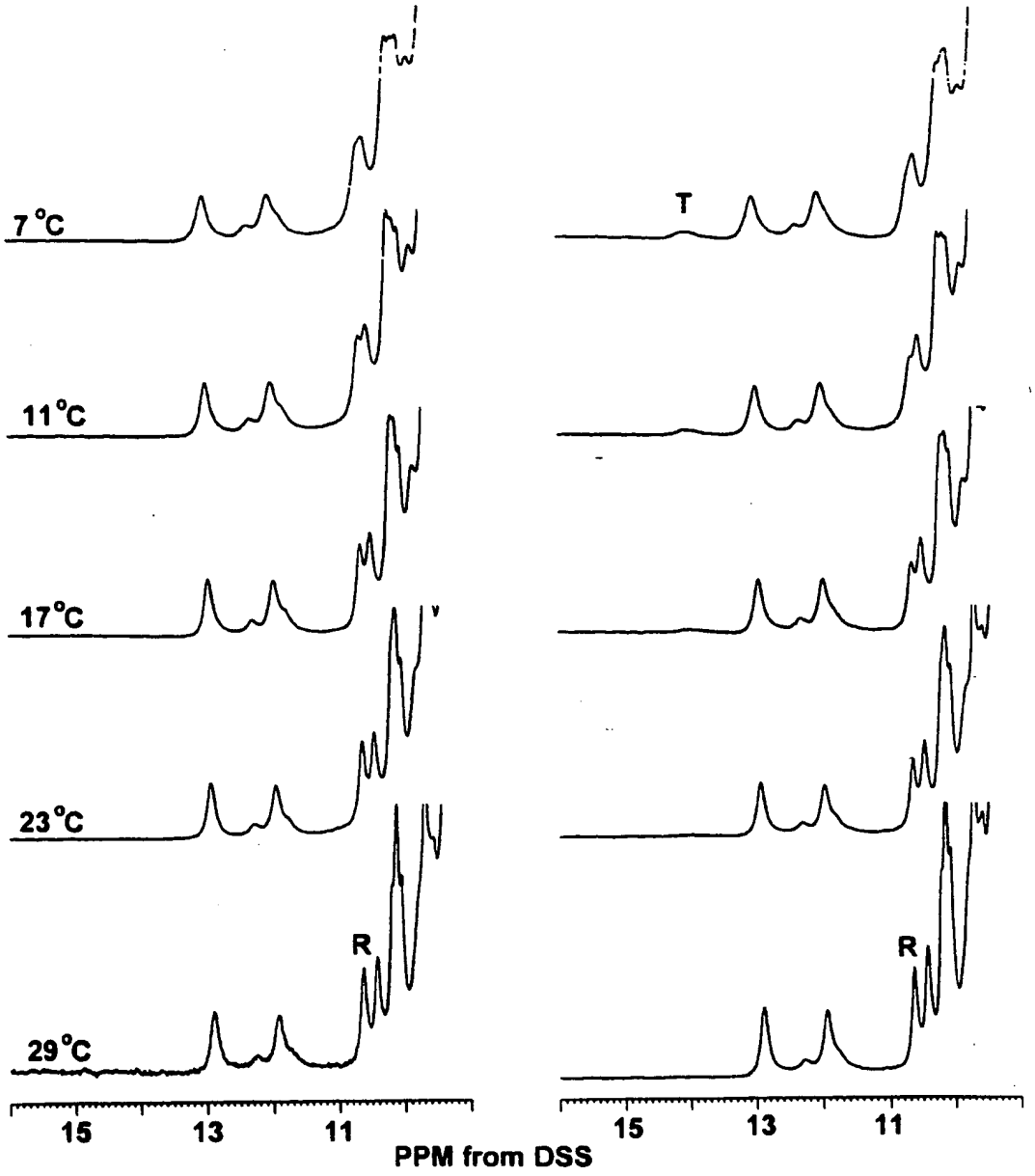


FIG. 9A

FIG. 9B

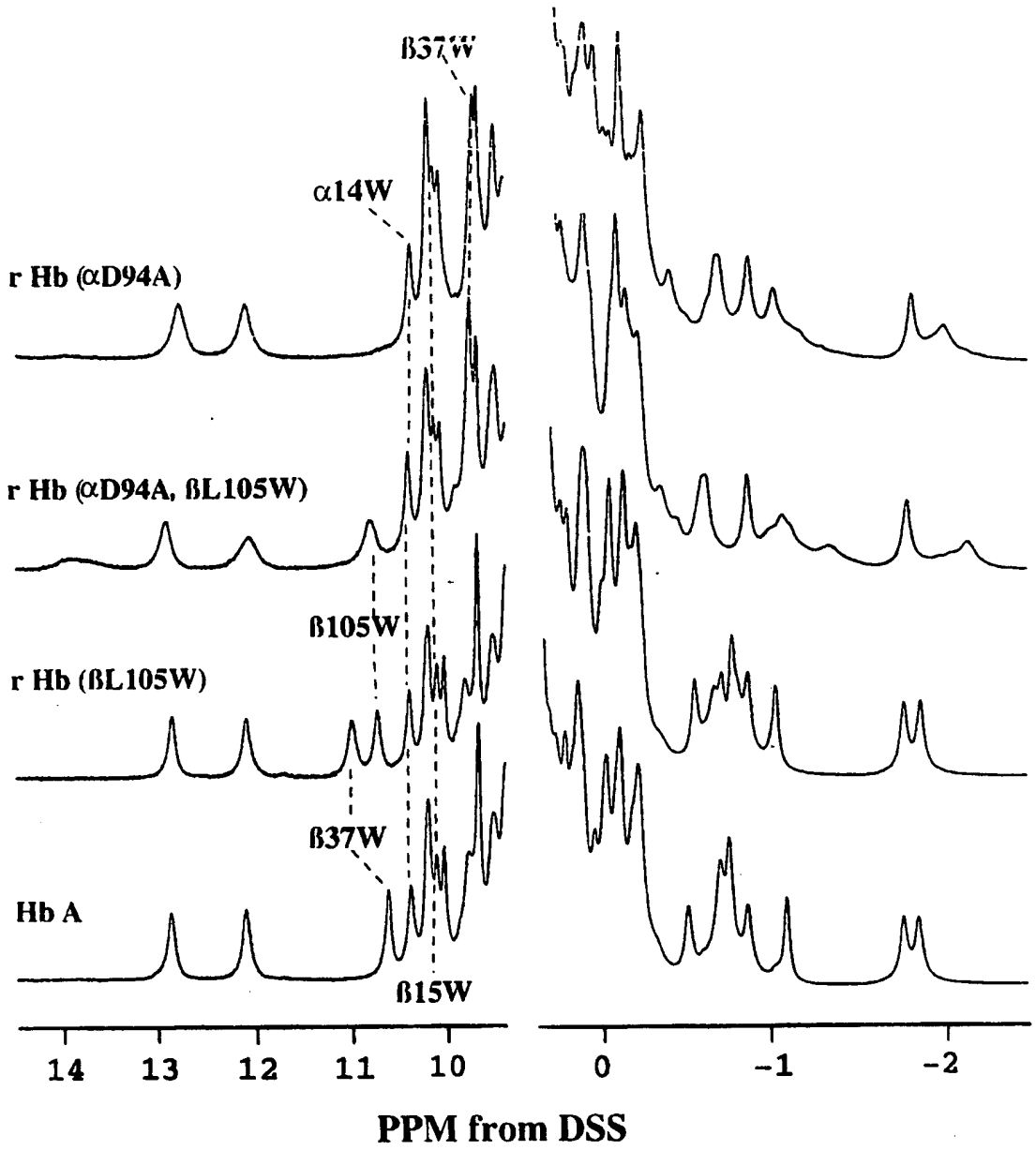


FIG. 10A

FIG. 10B

FIG. 11A

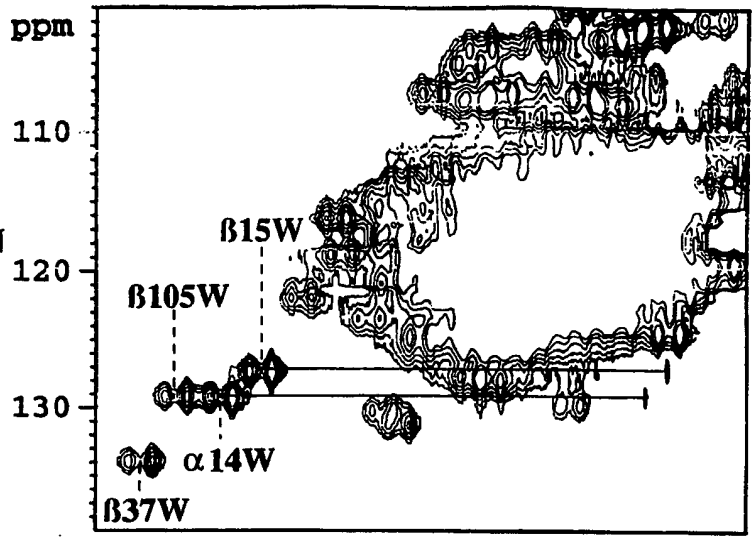
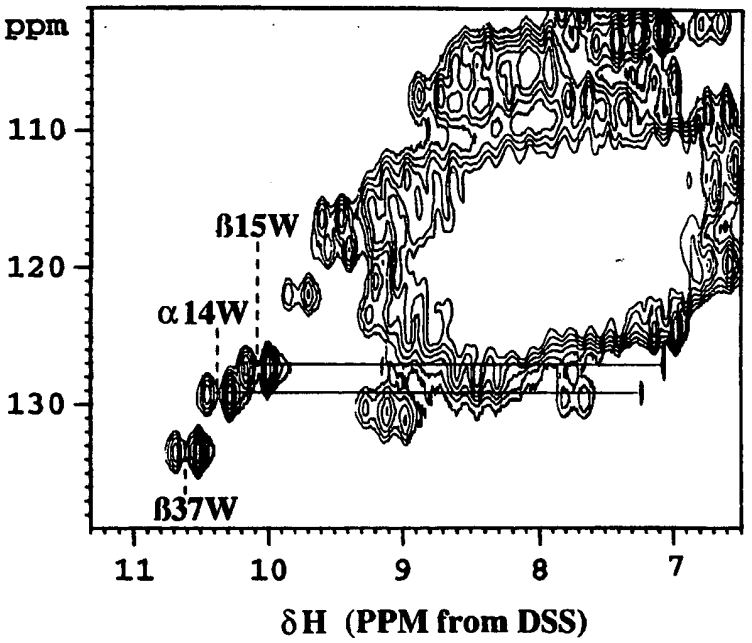


FIG. 11B



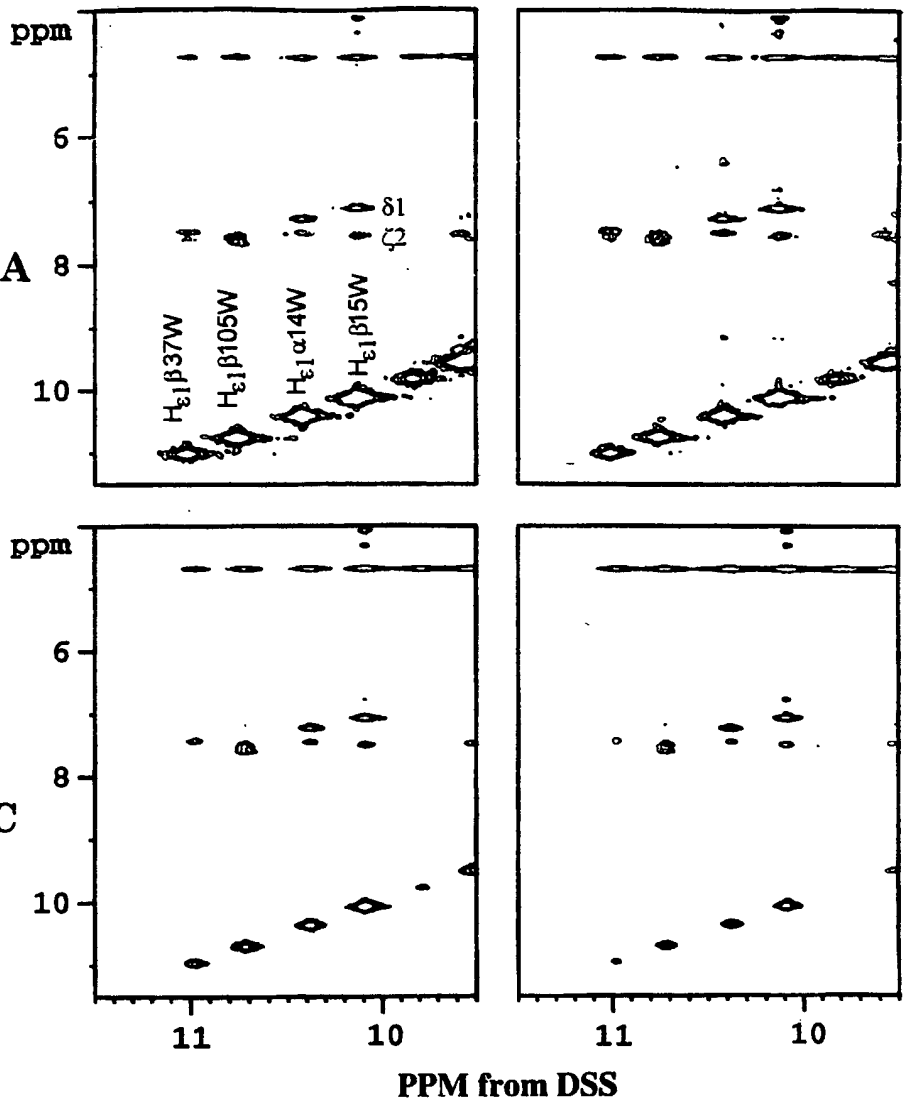


FIG. 12A

FIG. 12B

FIG. 12C

FIG. 12D

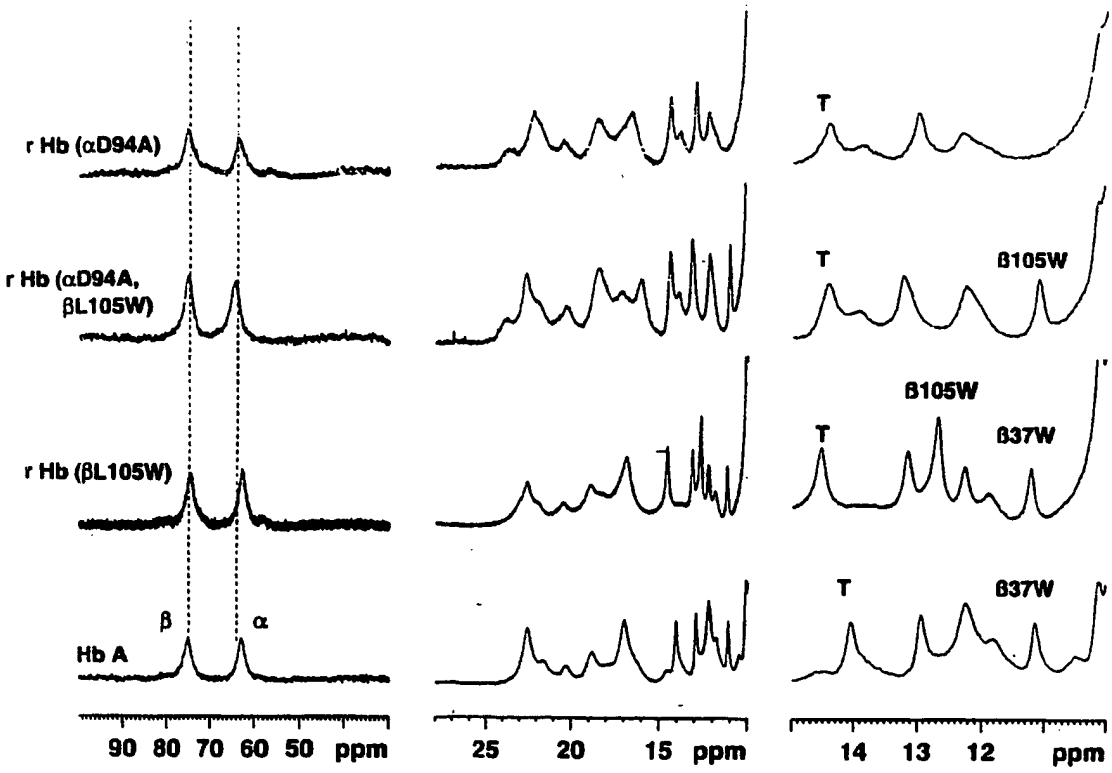


FIG. 13A FIG. 13B FIG. 13C

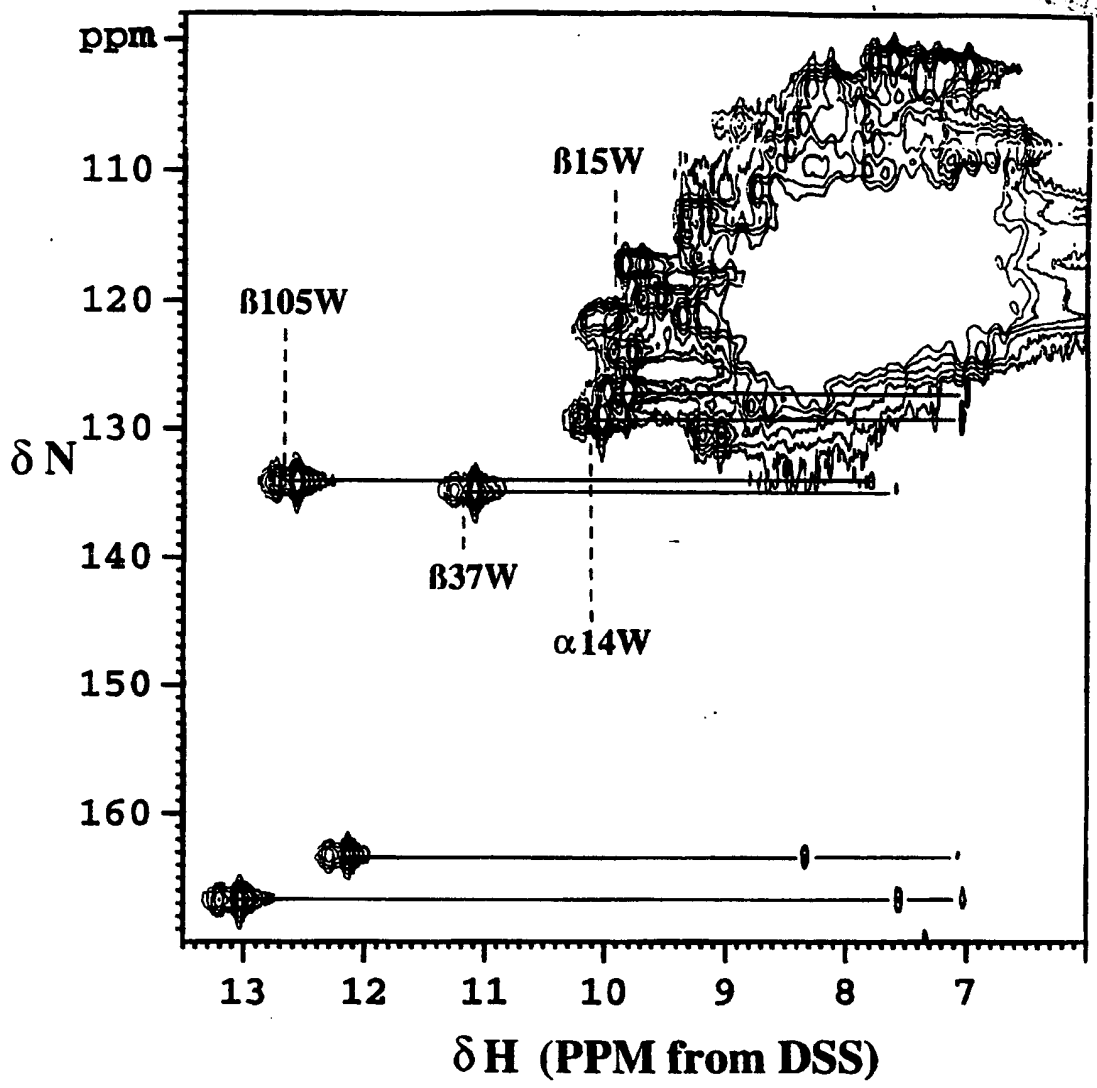

ppm
110
120
130
140
150
160
δ N
ß15W
ß105W
ß37W
α14W
13
12
11
10
9
8
7
δ H (PPM from DSS)

FIG. 14

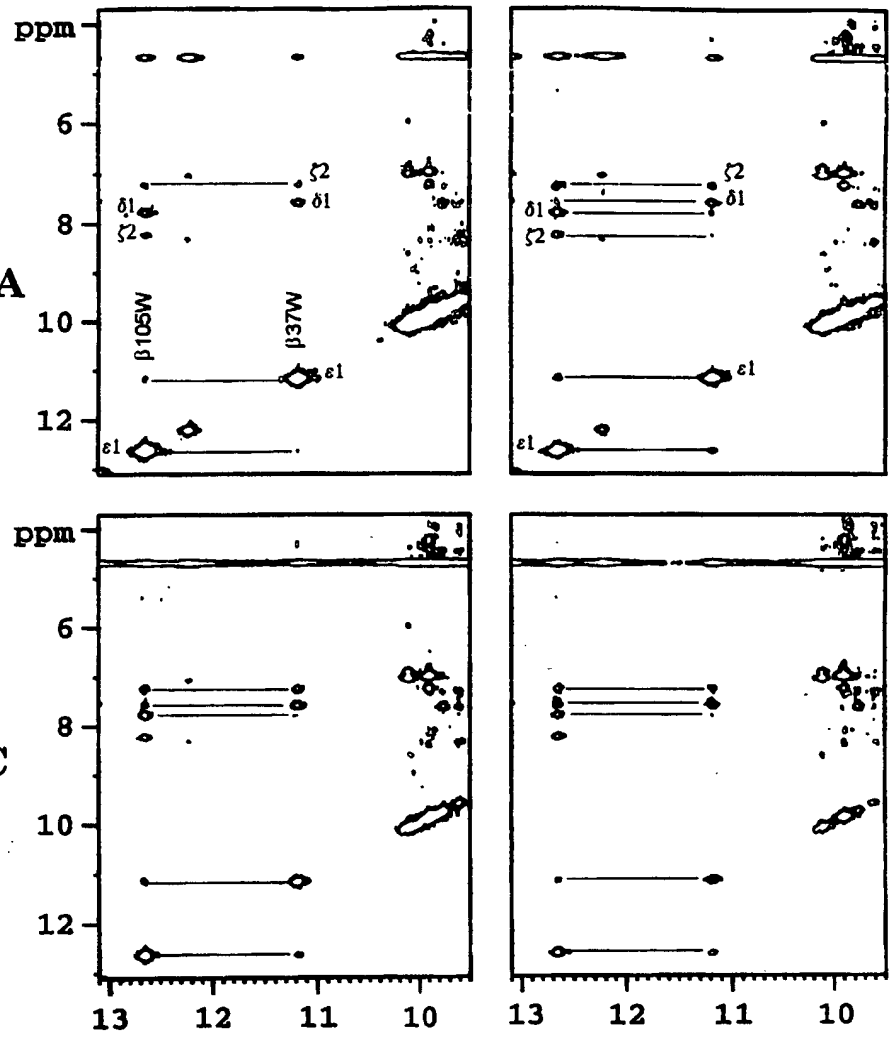


FIG. 15A

FIG. 15B

FIG. 15C

FIG. 15D

FIG. 16 A

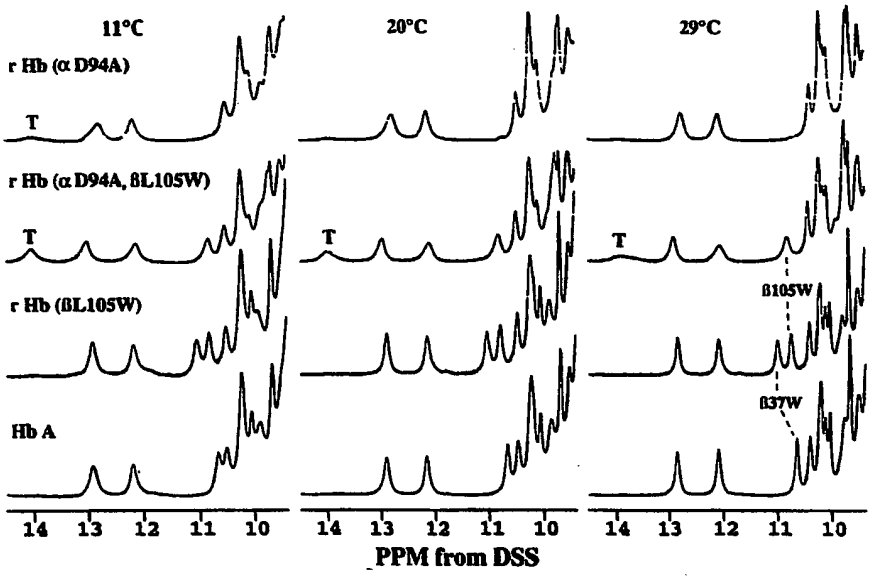
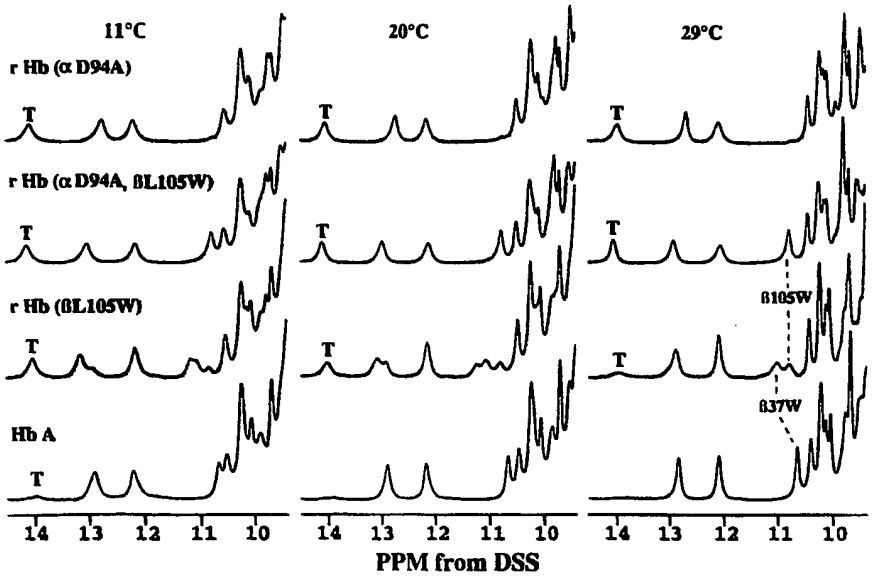


FIG. 16B



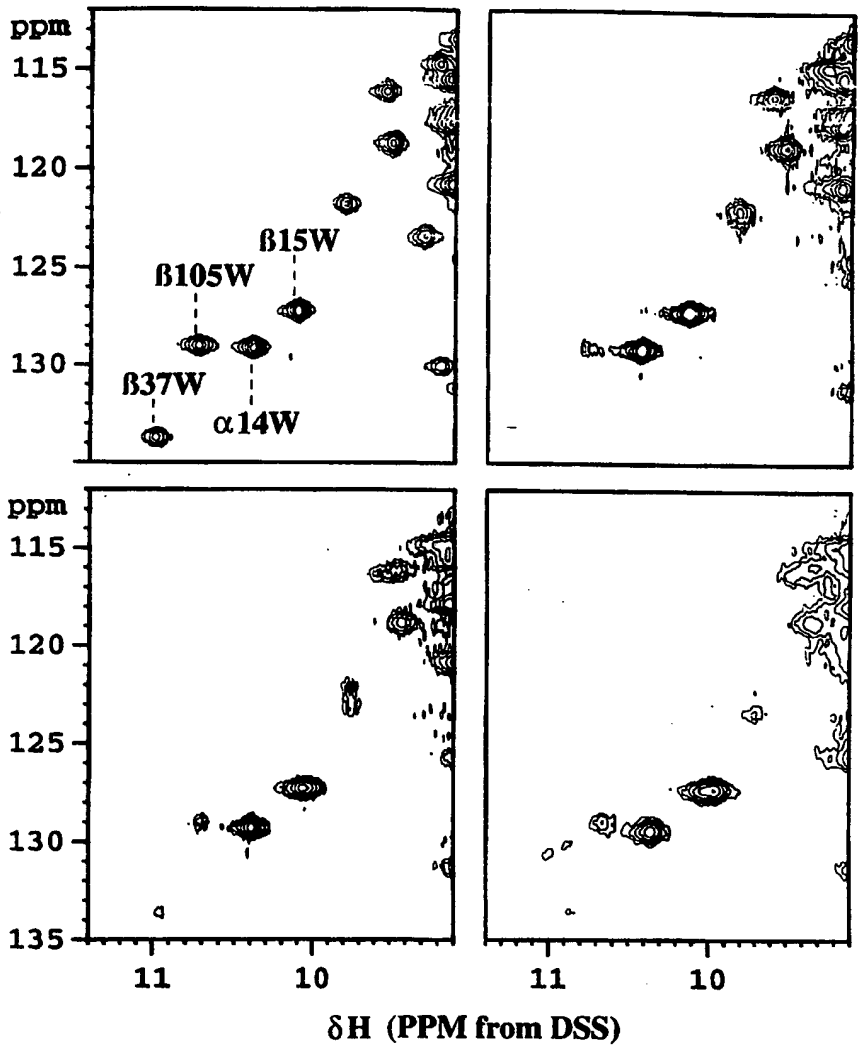


FIG. 17A

FIG. 17B

FIG. 17C

FIG 17D

FIG. 18A

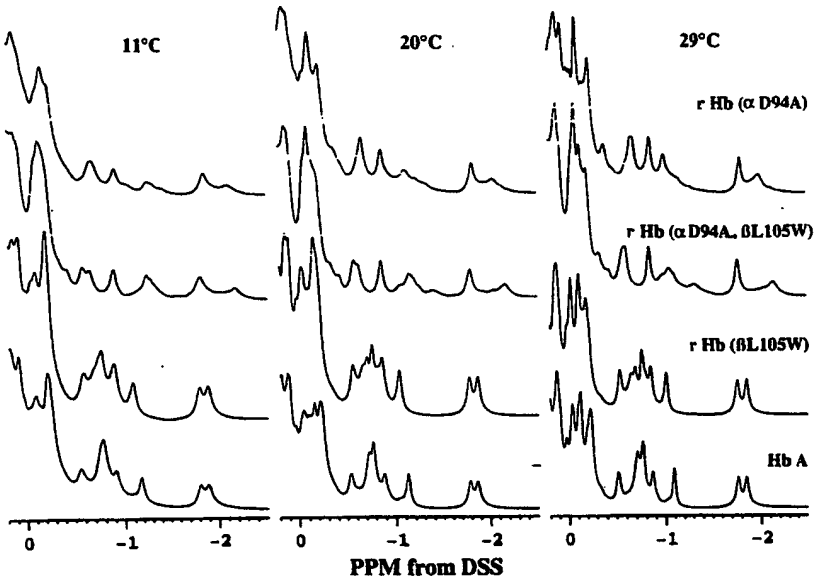


FIG. 18B